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TECHNICAL REPORT

74-20-PR

THE ACCEPTABILITY OF WHEY-SOY MIX AS A SUPPLEMENTARY FOOD FOR PRE-SCHOOL CHILDREN IN DEVELOPING COUNTRIES

DECEMBER 1973

An Interagency Project

for

U.S. Agency for International Development (AID)

and

U.S. Department of Agriculture (USDA)

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Consultants
to
U.S. Department of
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NLABS

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Pioneering Research Laboratory

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FOREWARD

On 12 June ~~1972~~ 1973, Secretary of Agriculture Earl L. Butz wrote to Secretary of the Army Howard H. Callaway, pointing out that USDA was faced with an extremely short supply of dry milk powder, a cornerstone in the AID administered PL-480, Title II commodity distribution program, noting that a USDA-AID group had a requirement to identify a new product for use with pre-school children by 1 Jan 74. He requested assistance from the U.S. Army Natick Laboratories (NLABS) to develop and test a methodology for determining the acceptability of this product and to monitor its use in field tests carried out by USDA.

The Department of the Army advanced this requirement to NLABS, an interagency agreement was reached, and funds were transferred to NLABS on 16 July 1973. The work was carried out by an NLABS team of psychologists and food technologists working with psychologists engaged by USDA. Over a three month period, acceptability criteria and acceptance methodology were developed and tested at the NLABS and in the Dominican Republic, and field tests were conducted in the Dominican Republic by the NLABS team and in five other countries by the USDA consultants.

This report presents the procedure, data, and conclusions concerning the field acceptability of the whey-soy beverage in the form required by USDA and AID in making their decision on the introduction of the new product. Minimum discussion of methodology development and evaluation is contained in this report.

We are pleased to have had the opportunity to be of assistance to the USDA in this important national program. This is an unusually good example of the implementation of the new policy of the Executive Branch on expanded interagency cooperation in the use of federal laboratories for national requirements when information is needed to guide the technical content of policy decisions relating to an urgent civilian need.[1]

Dale H. Sieling
Technical Director

S. David Bailey, Director
Pioneering Research Laboratory

[1]Memorandum from Dr. Edward E. David, Chairman, Federal Counsel for Science and Technology to George P. Shultz, Director OMB, 1 Mar 72 on Policy for Expanded Interagency Cooperation in the Use of Federal Labs

ACKNOWLEDGEMENTS

This report presents only those data obtained in the six-country field tests which were used as direct input for the AID-USDA decision on the introduction of the whey-soy beverage powder. However, the field tests themselves were the culmination of a large body of associated work on the development of criteria and techniques of acceptability testing at NLABS and in the Dominican Republic. This included sensory evaluation by consumer and technical panels, and product evaluation, e.g., specific gravity, moisture uptake, and boiling tests.

Many of our colleagues gave strong support in this endeavor, some to the extent of being included as authors, if this report covered this ancillary work.

In the Pioneering Research Laboratory, we should mention R. Kluter and J. Westerling, H. Meiselman and L. Branch. Dr. Herbert Hollander, Associate Director, Food Laboratory, actively encouraged his staff to participate. Among those who provided support were M. Klicka, M. Glickstein, J. Kapsalis, and M. Wolf. Special mention should be made of Mrs. Miriam Thomas, who helped in the Dominican Republic as well as NLABS, and B. Brady, Dietician, who consulted with us on product use and on nutrition education considerations.

We would like to thank J. Burger, A. Gala, and D. Nyren for outstanding secretarial and administrative support throughout the course of this project. Likewise, thanks are due to D. Kass and his staff of the Data Analysis Office for their support.

We should also mention the marvelous support and cooperation we received from the staff of the Voluntary Agencies in Chile, Vietnam, India, Pakistan, Sierra Leone and the Dominican Republic. Without fail, they gave generously of their time and effort in our behalf. Special thanks are due to the Dominican Republic group who patiently worked with us during our four-month stay.

Finally we thank the many mothers and children who partook of whey-soy beverage, answered our questions, provided our statistics, and, most importantly, taught us so much.

SUMMARY AND CONCLUSIONS

In the spring of 1973, a joint United States Department of Agriculture - Agency for International Development (USDA-AID) effort was begun to develop a nutritious beverage powder for use as a supplementary food for pre-school children in feeding programs in developing countries to which food is supplied through the Food for Peace program (PL-480, Title II). Work was undertaken because milk powder was in short supply, selling at record high prices, and was not expected to be available for Title II distribution. In order to continue programs, such as pre-school feeding programs, where beverage products were used, Food for Peace required a commodity which could be reconstituted with water to form a milk-like beverage. Based on research previously undertaken at USDA's Dairy Products Laboratory, it was decided that a whey-soy beverage powder could probably be used for this purpose, and pilot quantities of the new product were manufactured.

To determine whether the beverage powder would be acceptable to intended recipients, the U.S. Army Natick Laboratories were engaged to develop a method for testing the product and to assist USDA and AID in conducting the tests. A method for determining acceptability was developed and subsequently tested and refined in the Dominican Republic. It was agreed that the primary indicator of acceptability would be the proportion of pre-school children consuming an 8 ounce or larger serving of the reconstituted beverage powder and that the judgements of Voluntary Agency[1] representatives in each test country would be used to determine what proportion of children consuming the 8 ounce serving would be necessary to indicate an acceptable product. Secondary indicators used for assessing acceptability were opinions of the children's parents, distribution center staff, Voluntary Agency administrators, and local Food for Peace officers.

Acceptability tests were carried out by a team from the Natick Laboratories in the Dominican Republic and by USDA field investigators in five additional countries representative of Asia, Africa, and Latin America, which were Chile, Vietnam, India, Pakistan, and Sierra Leone. Over 4,000 tests with children and 2,000 with parents and

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[1] Voluntary Agencies, such as CARE, Catholic Relief Service, and Church World Services, administer in-country distribution of Food for Peace commodities.

feeding center staff were conducted. Measurements of beverage intake by children were made, and information and opinions of parents and feeding center staff were gathered by means of interviews.

The results indicate that the beverage powder should be acceptable when used in pre-school feeding programs in all test countries except possibly Sierra Leone. Since the tests were carried out in a variety of geographical areas and cultures and in several types of distribution systems, it may be concluded that there is a high probability that the beverage powder will be acceptable in pre-school child feeding programs in most parts of the developing world.

THE ACCEPTABILITY OF WHEY-SOY MIX AS A SUPPLEMENTARY FOOD FOR PRE-SCHOOL CHILDREN IN DEVELOPING COUNTRIES

INTRODUCTION

In 1972 and early 1973, in the face of rising food prices, commodity scarcities, and budget cutbacks, officials of the Food for Peace program, specifically the Title II donation part of that program, found it increasingly difficult to provide nutritious food in adequate volume to allow continuation of a large number of feeding programs in developing countries. Since cutbacks were inevitable, these officials felt that programs which provided food to the most nutritionally vulnerable group of recipients, namely pre-school children, should not bear the full brunt of these cutbacks. An ongoing re-focus of the agency's programs toward the pre-school child reinforced this decision. Non-fat dry milk, which had been a major food input into pre-school child feeding programs, had become by late 1972 a critically scarce commodity available only at prices double or even triple those of recent years. Therefore, it could not be feasibly procured for use in these programs. The decision was then made to seek an alternative, equally nutritious food which could be used in beverage form and which would be available at a price significantly lower than that of milk.

A joint effort aimed at finding such an alternative was established in late spring of 1973 involving the Agency for International Development and the U.S. Department of Agriculture. The effort was funded by the AID Office of Nutrition under an existing Participating Agency Service Agreement with the Economic Research Service. Scientists of USDA's Dairy Products Laboratory had done considerable basic research in previous years on a whey-soy beverage mix. It was determined that this provided a sound basis upon which to develop a milk-like beverage and that it was especially attractive as a means for utilizing whey, which has been a serious pollutant in U.S. streams and rivers. With additional input from food technologists, child nutritionists, and food programmers, a tentative product formulation was developed which called for a mixture of sweet whey, full-fat soy flour, soybean oil, corn syrup solids, and a vitamin and mineral mix. As formulated, this whey-soy beverage powder contained 20% protein, 20% fat, and levels of vitamins and minerals equivalent to those in other Title II blended foods. When reconstituted to 15% solids by weight, the beverage would be an approximate nutritional equivalent to whole milk. An eight-ounce

serving would provide roughly one-third of the daily protein requirements for a pre-school child and essentially the same proportion of calories to protein as provided by whole milk.

With a tentative formulation in hand, the next step in the process of developing a new beverage powder was to produce test batches and then subject the product to an array of tests to determine its nutritional value, storageability, and acceptance by recipients. Cost estimates were also to be made. One of the most important test areas was that involving acceptability testing.

Relatively little acceptability testing had ever been done previously with new foods being introduced into the Food for Peace program. This lack of experience made it desirable to seek outside assistance in developing a methodology for acceptability testing and in conducting the tests. For this purpose, an agreement was concluded between USDA and the Department of the Army which provided to USDA the expertise of the Pioneering Research Laboratory of the U.S. Army Natick Laboratories to develop, test, refine, and apply a methodology for determining the acceptability of this new beverage powder to pre-school children in developing countries. The contract called for determining if the USDA-AID beverage powder was acceptable or not, and if not, what changes would be required to make the product acceptable.

METHOD

The first step in developing a method for acceptability testing was to define acceptability as it relates to use of the food in Title II distribution. The purpose of the beverage powder project was to develop a supplementary food for use in pre-school child feeding programs in developing countries. It was therefore agreed that an acceptable beverage would be one consumed by pre-school children in developing countries in amounts sufficient to provide a nutritional supplement at a level which met feeding program requirements. AID and USDA determined that daily consumption of an eight-ounce serving would provide the desired nutritional supplement. The primary criterion of acceptability therefore became consumption of an eight-ounce or larger serving of the beverage by pre-school children.

It was also decided that a valid secondary criterion of acceptability was the mothers' opinions of the product as determined by their responses to the question of how well they liked it. Responses were measured on a five-point hedonic scale ranging from like very much to dislike greatly.

In order to make a judgement as to acceptability of the product from data collected relating to the primary and secondary criteria, it was necessary to establish standards of acceptability. These standards were determined by asking Voluntary Agency representatives in each country, first, what percentage of the target pre-school population they would allow to reject an eight-ounce serving of the product before rejecting the product, and second, what percentage of the mothers they would allow to dislike the product before rejecting it. They were asked to establish percentages allowed upon introduction of a food into their programs and after a food had reached its maximum acceptance. To come to a decision on acceptability, the data collected in field tests were compared to the percentages allowed at the introduction stage, since Voluntary Agency representatives indicated maximum acceptability would be reached only after periods of exposure to a new food ranging from 4 to 10 months.

Data on other indicators of acceptability and on product characteristics were also gathered. These included feeding center staff like or dislike of the product, both mother and staff opinions on how well the children liked the product, and mother and staff consumption of the product. Questions were also asked concerning properties of the beverage, such as taste, odor, texture, and similarity to other foods known in the area and concerning changes in the product which would make it more acceptable. Interviews were also conducted

with Voluntary Agency administrators and local Food for Peace officers to gather their opinions on the product's acceptability and potential for success in their feeding programs.

Field tests to determine acceptability of the whey-soy beverage powder were carried out over a ten-week period, beginning September 1, 1973, in Chile, Vietnam, India, Pakistan, Sierra Leone, and the Dominican Republic. In all countries except the Dominican Republic, the tests were carried out by one or both of two USDA representatives, William I. Rodier, III, and William C. Wetsel. Testing in the Dominican Republic was done primarily by a team from the U.S. Army Natick Laboratories consisting of H. L. Jacobs, R. C. Graeber, H. R. Moskowitz, D. Waterman, and T. J. E. Reed. Beverage intake testing and interviews were generally conducted by local nationals who were, for the most part, employees of CARE. More than 4,000 tests were conducted among pre-school children and 2,000 among mothers and feeding center staff. These numbers include re-tests carried out in long-term distribution programs. Testing was done in over 60 feeding centers in these six countries. Most test sites were administered by CARE, although some Catholic Relief Service and Church World Services centers were involved.

Measurement of beverage consumption by pre-school children, which is the primary indicator of acceptability, was taken during normal feeding times at wet centers, that is, centers where prepared food is regularly served. In dry centers, where food is not normally served, but distributed for preparation at home, children were fed at a time when they would be expected to be hungry. Consumption by mothers and feeding center staff, where intake tests could be conducted, was measured at the same time. Mothers and staff were then interviewed for their opinion of the product.

Testing was conducted according to two different designs: (1) one-day tests in which intake measurement and interviews were conducted upon first exposure to the product, and (2) long-term tests where these measures were taken initially and later, after the subjects had been exposed to the beverage powder for periods varying from one week to more than two months. (See Table 1) These long-term tests served as a basis for identifying changes in intake and opinions which could be evaluated as a function of time and experience. In each country except the Dominican Republic, a minimum of five one-day tests and three long-term tests was conducted. In countries where non-fat dry milk was usually sweetened, both plain and sweetened whey-soy beverage was tested, although not in the same centers.

Table 1. Overall Testing Plan

Distribution	Product Experience	Day 1	No. Days Experience	Final Day
Wet	One-day Long Term	Test Test	-- 6-9	-- Test
Dry	One-day Long Term	Test Test	-- 18-63	-- Test

FIELD TEST RESULTS

Chile

A total of five one-day tests and three long-term tests were administered in government-sponsored day-care centers located in the vicinity of Santiago. All children were receiving sweetened non-fat dry milk at the test sites. Therefore, some centers were tested with sweetened beverage powder, while others received it plain. No dry distribution centers were available for testing in Chile.

Table 2. Summary of Child Intake and Mother Acceptance Data for Chile

Data Type	Product Tested		Whey-Soy		Whey-Soy + Sugar		Voluntary Agency Representatives' Criterion
	Site-type		Wet		Wet		
Intake	Children consuming at least 8 oz.	One-day	19%	(124)*	61%	(115)	66%
		Long Term Initial	17%	(126)	68%	(112)	
		Retest	89%	(112)	95%	(64)	
Questionnaire	Mothers liking product	One-day	75%	(26)	88%	(33)	64%
		Long Term Initial	32%	(17)	100%	(15)	
		Retest	-	(0)	-	(0)	

*( ) = Number of subjects

The results of tests conducted in Chile are shown in Table 2. Intake data in this table demonstrate that while initial acceptance of the plain beverage powder by children was low, exposure to the product for longer periods of time resulted in increased acceptability. These tests were conducted over a 21 - 30 day period. A similar trend of increased acceptability over time is also evidenced in the sweetened beverage powder results. It should be noted, however, that although initial acceptance levels for the sweetened beverage powder are higher than those for plain, acceptability for these two commodities was very similar by the end of the test period. Eighty-nine percent of the children consumed eight ounces or more of the plain beverage and 95% consumed a similar amount of the sweetened beverage. These results exceed the 66% level specified by Voluntary Agency representatives in Chile for an acceptable product. These percentages in fact exceed the 82% rate they would specify for a commodity after it achieved maximum acceptability, which they estimated would likely occur after 4-5 months.

Data for two of the secondary indicators of acceptability, namely, mother and staff opinions of the product, show that a bare majority of respondents in the one-day tests liked the plain beverage, while the sweetened product was much more acceptable to them. Unfortunately, no retest data were collected for these subjects in Chile. The 58% average acceptance of the plain product by mothers in both one-day and long-term tests would place it slightly below the 64% rate specified by Voluntary Agency representatives, whereas the 92% average acceptance of the sweetened product in both one-day and long-term tests places it well above the allowed minimum.

Since the data for the primary indicator of acceptability are definitely within the allowable range in Chile, the beverage powder is judged acceptable for use in that country.

Vietnam

A total of seven one-day tests and three long-term tests were executed in the Saigon area. Some were run in CARE-supported private orphanages or nurseries and some in government orphanages or nurseries. All sites were centers to which cooled, reconstituted non-fat dry milk in 6-gallon containers is delivered each morning from the Foremost Foods Company plant in Saigon. In eight of the centers, tests were run with the beverage powder similarly reconstituted, cooled, delivered, and served at the time of normal milk distribution. At the remaining two sites, the beverage powder was reconstituted at the site and served at room temperature. No dry distribution centers were tested in Vietnam.

Table 3. Summary of Child Intake and Mother Acceptance Data for Vietnam

Data Type	Product Tested Site-type		Whey-Soy Wet		Voluntary Agency Representatives' Criterion
Intake	Children consuming at least 8 oz.	One-day	82%	(574)*	55%
		Long Term Initial	61%	(209)	
		Retest	65%	(134)	
Questionnaire	Mothers liking product	One-day	42%	(41)	45%
		Long Term Initial	-	(0)	
		Retest	-	(0)	

*( ) = Number of subjects

Test results are shown in Table 3. An average of 70% of the children tested upon initial exposure to the product in both one-day and long-term tests consumed eight ounces or more. Exposure to the product for 7-9 days in long-term tests did not significantly increase the rate of acceptance. This 70% level is above the 55% rate specified by Voluntary Agency representatives. Acceptance of the beverage powder by mothers was relatively poor. Of the mothers responding, only 42% indicated that they liked the beverage. This falls below the 55% level specified by Voluntary Agency representatives. In contrast, staff members interviewed indicated that they, and the children they had observed, liked the beverage.

Since the number of children drinking an eight-ounce serving fulfilled the primary criterion of acceptance set by local Voluntary Agency representatives, the beverage was found acceptable for use in Vietnam.

India

Tests were run in the cities of Bombay and Calcutta and in areas of Tamil Nadu bordering the city of Madras. Two one-day tests were run in each location. In addition, two long-term tests were conducted in Bombay and Calcutta and one in Madras. All centers were either publicly- or privately-sponsored day care centers or maternal-child health centers. No dry centers were tested in India.

Table 4. Summary of Child Intake and Mother Acceptance Data for India

Data Type	Product Tested / Site-type		Whey-Soy / Wet		Voluntary Agency Representatives' Criterion
Intake	Children consuming at least 8 oz.	One-day	49%	(534)*	49%
		Long Term Initial	50%	(430)	
		Retest	60%	(485)	
Questionnaire	Mothers liking product	One-day	48%	(83)	46%
		Long Term Initial	59%	(49)	
		Retest	42%	(41)	

*( ) = Number of subjects

Results are shown in Table 4. Approximately 49% of the children consumed an eight-ounce portion initially, and more than 60% consumed that amount after exposure to the product for a period of 8-25 days. Acceptance was quite high in Calcutta at a level of 80%,

while in Tamil Nadu and Bombay acceptance was less even after product exposure. Consumption in these areas was at levels of 60% and 40%, respectively. In the Tamil Nadu area the somewhat lower consumption rate may have been accounted for by the high proportion of children under four years of age who, in the field investigators' opinion, obviously had some trouble consuming a full eight-ounce portion. Voluntary Agency representatives in India stated that a 50% consumption level would indicate an acceptable product. While the Calcutta, Tamil Nadu, and all-India average levels were above this level, the 40% rate in Bombay fell below it.

In both the one-day and long-term tests, an average of 50% of Indian mothers indicated they liked the product. However, this figure was only 11% in Bombay, but 90% in Calcutta. For all-India, this secondary indicator of acceptability exceeded the 46% level of acceptance allowed by Voluntary Agency representatives. Of the staff interviewed, 47% indicated they liked the product.

Since the primary criterion of acceptability was met by Calcutta, Tamil Nadu, and all-India consumption rates, the beverage powder is judged to be acceptable in India as a whole, but probably not in the Bombay area.

Pakistan

Seven one-day tests, two long-term tests in wet centers and two long-term tests in dry centers were executed. All tests were run in the area of Karachi in both private and government-sponsored day care centers, clinics, or maternal child health centers.

Table 5. Summary of Child Intake and Mother Acceptance Data for Pakistan

Data Type	Product Tested / Site-type		Whey-Soy Wet		Whey-Soy Dry		Voluntary Agency Representatives' Criterion
Intake	Children consuming at least 8 oz.	One-day	36%	(154)*	-	(0)	
		Long Term Initial	42%	(71)	-	(0)	60%
		Retest	63%	(60)	71%	(52)	
Questionnaire	Mothers liking product	One-day	48%	(25)	-	(0)	
		Long Term Initial	-	(0)	-	(0)	69%
		Retest	-	(0)	94%	(39)	

*( ) = Number of subjects

The results are presented in Table 5. Initial consumption of an eight-ounce serving of the beverage in wet centers was somewhat low, with an average of 40% of the children consuming the entire portion. However, exposure of the children to the product for a period of 8-25 days resulted in an increase in acceptance to the point where more than 60% consumed the eight-ounce serving. After 22-25 days exposure to the beverage powder distributed from dry centers, more than 70% of the children consumed an eight-ounce serving. No initial tests were done in these dry centers. The consumption level of the product after exposure in wet and dry centers for periods ranging from 8 to 25 days falls slightly above the 60% rate specified by Voluntary Agency representatives.

Acceptance of the beverage powder by mothers was good. An average of 76% of the mothers in one-day and long-term tests said they liked the beverage. This exceeds the 69% level specified by the Voluntary Agency representatives.

Since tests conducted after repeated exposure to the product over a relatively short period of time indicated acceptance of the product at a level which meets the primary criterion, and since mother acceptance was above the specified level, the product was found to be acceptable for use in Pakistan.

Sierra Leone

A total of five one-day tests, and seven long-term tests were conducted in dry distribution centers, and two one-day tests were run in wet centers. All tests were run in the Freetown area in private clinics, day care centers, or maternal-child health centers.

Table 6. Summary of Child Intake and Mother Acceptance Data for Sierra Leone

Data Type	Product Tested Site-type		Whey-Soy Wet		Whey-Soy Dry		Voluntary Agency Representatives' Criterion
Intake	Children consuming at least 8 oz.	One-day	58%	(132)	41%	(140)	55%
		Long Term Initial	-	(0)	13%	(83)	
		Retest	-	(0)	44%	(140)	
Question-naire	Mothers liking product	One-day	89%	(9)	86%	(28)	45%
		Long Term Initial	-	(0)	100%	(20)	
		Retest	-	(0)	92%	(59)	

*( ) = Number of subjects

Results are shown in Table 6. An average of 49% of the children in one-day and long-term tests consumed eight ounces or more with a single exposure to the product. Exposure of the children to the beverage powder in the dry form at home for 18 to 43 days did not improve this result. This 49% figure does not meet the standard of the Voluntary Agency representatives, who would require 55% of the children to consume at least eight ounces.

Acceptance of the beverage powder by mothers was relatively high. An average of more than 70% of those responding in both one-day and long-term tests indicated that they liked the beverage.

In the past, non-fat dry milk had been distributed in Sierra Leone as a dry powder and subsequently used in the home as a porridge ingredient. Field investigators indicated that the whey-soy beverage powder was used in a similar manner. Therefore, there was no long-term exposure to the product in beverage form. Since tests required its use in this form, the novelty of the beverage to the children perhaps negatively biased the results.

Nevertheless, since data for the primary criterion of acceptability did not reach the levels set by the Voluntary Agency representatives in the one-day test, and since acceptance did not improve over time, the beverage powder is judged as unacceptable for use in Sierra Leone.

Dominican Republic

The Dominican test centers were located primarily within a 30 mile radius of Santo Domingo, but extended as far east as San Pedro Macoris and as far west as Barahona Province. Testing was conducted in three dry centers for nine weeks and in twelve wet centers for a maximum of eight days. The dry distribution centers were located in government-sponsored health clinics which received commodities through CARE and were tested only with plain whey-soy powder. All wet centers belonged to maternal child health programs sponsored by Voluntary Agencies. In four of these wet centers, sweetened non-fat dry milk was tested in order to compare the acceptability of the new whey-soy beverage with that of a familiar and highly successful beverage. Of the other remaining eight wet centers, half were tested with plain whey-soy, and the other half with sweetened whey-soy beverage.

It is important to note that unlike most of the other test countries, all centers in the Dominican Republic were still distributing non-fat dry milk until the time testing began. Also, the method of distribution in almost all Dominican wet centers differed greatly from that found in the wet centers of the other test countries. In this country, participants' daily allowance was distributed early each morning for home consumption rather than the method of on-site consumption as in the other countries.

The results for both the whey-soy product and sweetened non-fat dry milk are presented in Table 7. Upon initial introduction to the whey-soy beverage, only 32% of the children consumed at least eight ounces; but, when sugar was added, this figure increased to 56% (wet and dry centers combined). The initial consumption figure for sweetened non-fat dry milk was 70%. After six to eight days' experience, there was a percentage drop in consumption for all three products in the wet centers; however, the level of consumption in dry centers after nine weeks' experience increased from 32% to 52%.

In response to the questionnaire, 92% of the mothers indicated they liked the plain whey-soy beverage after initially sampling the product while 95% gave a positive response after long-term experience with the beverage. In contrast, the comparative figures for sweetened non-fat dry milk were only 84% and 85% respectively and for the sweetened whey-soy beverage they were 93% and 63%. The rather large decrease in positive responses after experience with the sweetened whey-soy beverage is due primarily to the data collected at one center where all mothers reported the beverage developed a very lumpy and unpleasant quality after being boiled at home before serving. However, these reports were not substantiated by the data collected at other similar centers where home boiling occurred nor by a laboratory evaluation of the boiled product. It therefore appears that the mothers at this one particular site may have been attempting to severely discredit the product in order to maintain their supply of non-fat dry milk.

In relating the test results to the Volunteer Agencies' criteria, it is important to realize that the Dominican criteria are much more stringent than those of any other test country. This difference is a result of asking the representatives for only one criterion figure instead of two, one appropriate for initial introduction of the product and one appropriate for a time when maximal acceptance would be expected. The criterion percentages used to evaluate the results in the other test countries were those given as estimates for initial acceptance and are therefore relatively low. The child intake results for the Dominican Republic, especially after sugar had been added to the whey-soy beverage, are fairly close to the appropriate criteria determined in the other five

Table 7. Summary of Child Intake and Mother Acceptance Data for Dominican Republic

Data Type	Product Tested		Whey-Soy		Whey-Soy		Whey-Soy + Sugar		NFDM** + Sugar		Voluntary Agency Representatives' Criterion
	Site-type		Wet		Dry		Wet		Wet		
Intake	Children consuming at least 8 oz.	One-day	-	-	-	-	29%	(7)*	70%	(54)	
		Long Term Initial	40%	(37)	30%	(44)	58%	(77)	70%	(51)	72%
		Retest	32%	(19)	52%	(21)	40%	(52)	54%	(66)	
Question-naire	Mothers liking product	One-day	-	-	-	-	94%	(18)	100%	(5)	
		Long Term Initial	86%	(50)	96%	(70)	93%	(22)	84%	(77)	86%
		Retest	92%	(39)	100%	(26)	63%	(51)	85%	(52)	

*( ) = Number of subjects

**Non-fat dry milk

countries. It should also be noted that even the intake of sweetened non-fat dry milk, which is considered a highly successful beverage commodity in the Dominican Republic, does not reach the criterion level. In fact, consumption of this product upon retesting was as low (54%) as that observed for the whey-soy beverage in two types of tests (58% and 52%). One very likely reason for the relatively low consumption percentages for all products in this country is the fact that children did not normally consume a beverage at the wet or dry centers. Field observations suggest that the presence of foreigners (Natick Staff) may have inhibited the children's drinking. Also, the fact that the children customarily consumed the beverage at home with additional flavoring (not just sugar) may have confounded the test results in which the children consumed the whey-soy plain or only with sugar.

The secondary criterion of mothers' liking the product is clearly satisfied in all but one case. In view of this fact and in light of the child intake considerations discussed above, the whey-soy beverage should be acceptable for distribution in the Dominican Republic.

CONCLUSIONS

Testing of the whey-soy beverage powder was carried out in Chile, Vietnam, India, Pakistan, Sierra Leone and the Dominican Republic to determine its probable acceptability for use as a supplementary food for pre-school children. Test results indicated that the beverage powder should be acceptable in all test countries except possibly Sierra Leone. Moreover, since the tests were carried out in a variety of geographical areas and cultures and in several types of distribution systems, it may be concluded that there is a high probability that the beverage powder will be acceptable in pre-school child feeding programs in most parts of the developing world.